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CONCERNING SPECTROPHOTOMETRIC STAR REFERENCES DURING PLANETARY OBSERVATIONS

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CONCERNING SPECTROPHOTOMETRIC STAR REFERENCES DURING PLANETARY OBSERVATIONS*

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ABSTRACT. The method commonly used to eliminate varying atmospheric transparency on the results of planetary observations is criticized. The method is based on photographing the spectrum or direct image of a star.

The method widely employed of eliminating the influence of varying /104** transparents in the atmosphere of the Earth in connection with planetary observations by means of photographing the spectrum of a star or its direct image requires a critical approach. Otherwise significant errors may arise of a systematic or random nature.

A stellar image, as a point-source object, surrounded by a dark background and planetary detail, surrounded by a "background", the brightness of which is compared with the brightness of the detail itself, are formed at the focal point of a telescope in different ways. In this connection also the images of the stellar spectrum and the details of an extended object form in different ways on photographic film in a system which consists of a telescope in a slit spectrograph. Diffraction, atmospheric turbulence and dispersion, chromatism of the telescope (if the latter is a refractor or has lens elements) have different effects for a star and for the image of a planetary detail. In the case of planetary details overlapping of the effect of adjacent points of the image occurs.

While not discussing in detail the various aspects of stellar references in connection with the photographic filter observations (where the scatter disk of the stellar image acts as an instrumental profile in connection with the formation of the planetary image), we shall examine certain circumstances of spectral observations.

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*Address during discussion on reports.

**Numbers in the margin indicate pagination in the foreign text.

The scatter disk, or the stellar image at the slit of the spectrograph, is a complex color formation. The image furnished by the refractor has a complexity of spectral microstructure which is caused first of all by chromatic aberation of the telescope objective. Chromatic scintillation and atmospheric dispersion represent a second factor which causes non-uniform color structure in the point image. It has an equal effect both in the case of a refractor as well as in the case of a reflector. If, as usual, the entire stellar image is not "thrown across" the slit of the spectrograph, a certain selectivity in the formation of the spectral image appears at the light receiver, which depends on the zenith distance of the star, the orientation of the spectrograph slit with respect to positional angle and on other factors, not constant with respect to time due to variability in certain positive factors.

The variability of this selectivity, its systematic differences for a star and for a planetary image point may also serve as causes of error if /105
a certain significant portion of the spectrum radiates.

Chromatic scintillations, as a rule, have a comparatively high-frequency nature and may operate only in connection with short exposures and during spectrum scanning. Atmospheric dispersion in connection with the use of narrow spectrograph slit (smaller than the disk -- the stellar image) leads to a different relative light contribution by different wavelengths in connection with image formation at the light receiver. If the scatter disk has a greater value than the atmospheric dispersion, the phenomenon is weakened somewhat but still remains and cannot be disregarded.

Since atmospheric dispersion is directed along the vertical, we may suggest, as the simpliest method of reducing its influence (but unfortunately not its complete elimination) the orientation of the input slit in the vertical plane during the photographing of a stellar spectrum.

In addition, it is obvious that no matter how valuable night observational time, one must avoid within possible limits, operations at great zenith distances of the star and poor images. Practice reveals that difficulties which arise in connection with the interpretation of observational material and part

of the remaining uncertainity in the reliability of conclusions places under doubt the expediency of abundant material without sufficient exacting demands for observational conditions. Of course, depending on the specific task, instrumental conditions and weather conditions other variations in an approach to the problem discussed are also possible. The observer himself can and must select the required and applicable working conditions.